SCIENCE

FRIDAY, MAY 4, 1888.

THE SUGGESTIONS which Dr. Gouverneur M. Smith makes, in an article contributed by him to the *New York Medical Record*, an abstract of which we give in this number of *Science*, are most excellent, and, so far as we are able to judge, are also entirely practical. The two things which are especially lacking in the lives of those who live in tenement-houses are fresh air and sunshine. This is especially true of the invalids, so many of whom are found among the poor and unfortunate of all large cities. While those of this class who have health and strength may find recreation and an opportunity to expand their lungs in the parks, the sickly ones must remain, often year after year, in the confined, and not infrequently dark bed-chambers of a thickly populated tenement-house. Many such could be transported to the roofs, while they could not be taken to the public pleasure-grounds; and if these were so constructed as to admit sunlight and fresh air, and at the same time to exclude the wind and the rain, and were made attractive by the presence of a few flowering plants, the results could not but be beneficial, and repay a thousand-fold the money expended in making the necessary alterations. There is at the present time one serious impediment to a general adoption of such a plan. The sewer-system of New York, and of other cities as well, contemplates the extension of soil and waste pipes of all dwellings to the roof, so that the foul air, produced by the decomposition of the filth which they carry, may find a ready escape into the outer air, and not obtain an entrance into the dwelling-rooms. In many cases these pipes are trapped from the street-sewer, in many others they are not; and in either case the gases which escape at the roof are offensive, and undoubtedly detrimental to health. The writer recalls a case of continued fever, which was contracted by a young man, who, unable to leave the city during the summer, was in the habit of spending his evenings on the roof of his dwelling. The soil-pipe, untrapped from the sewer, extended above the roof, and the odors which escaped therefrom were often so offensive that he could not remain on the roof with comfort. In a thickly settled tenement district this evil would be greatly magnified. In the elaboration of any plan, therefore, for the arrangement of the roofs of our city houses so that they may be utilized as pleasure and health resorts, this important element of ill health must not be overlooked. We shall be glad to open the columns of *Science* to the discussion of this subject, and to reproduce any feasible designs which architects or others may devise for the carrying-out of the plan suggested by Dr. Smith.

THE FRENCH EDUCATIONAL WORLD is discussing with interest a recent innovation at the Collége de France, to which we have already referred in *Science*. That institution, ranking as the representative of the higher education, and having connected with it some of France's most eminent scholars, has converted a chair at the college into a chair of 'experimental and comparative psychology.' This is a very high tribute to the new psychology, and this illustrious example will, it is hoped, induce other institutions to take a similar step. M. Paul Janet contributes an extensive article in the *Revue de Deux Mondes*, outlining the interests which the new professorship is to represent, and defending it against certain misrepresentations to which it has been laid open. The occupant of the new professorship is Th. Ribot, whose name is well known to English readers, and all of whose works have been translated and editions published in America. His three monographs — upon the 'Diseases of Memory,' the 'Diseases of the Will,' and the 'Diseases of Personality' — are most admirable introductions into the studies with which they are concerned. His work upon the psychological aspects of heredity is of standard value, and his compilations of the systems of English psychologists and of German psychologists are hardly less serviceable. M. Ribot will in his new sphere be able to still further widen his useful influence by imparting to young men the same enthusiasm and liberality of thought which he has shown in his works, and nowhere more than in his able editorship of the *Revue Philosophique*, whose founder he is. The opening address of his course Professor Ribot (*Revue Scientifique*, April 11, 1888) devoted to a brief survey of psychological work in Europe and America. He finds everywhere encouraging examples of good work by scientific methods, and draws a very hopeful picture of the strides that this young science seems destined to make in the near future. The step that the Collége de France has thus taken is an indication of the *raison d'être* which scientific psychology has already proved for itself; and a similar reform is doubtless to take place elsewhere. It is gratifying to add that the educational institutions of this country are beginning to realize the propriety of such a step, and of having a representative of the new psychology in their faculties.

NO DEPARTMENT OF PHYSICAL RESEARCH is more fascinating to the biological investigator, or more transcendently important to the human race, than that one of comparatively recent development, the study of micro-organisms and of their agency in producing disease. It is to be regretted that Dr. Sternberg, who was employed by the government to make the inquiry in regard to the existence of a yellow-fever germ, and the feasibility of securing protection from that dread disease by inoculation, was not permitted to pursue his investigations to a more satisfactory conclusion. His report, as it is, will be a very important one, although it will afford no encouragement to those who are striving to account for every known disease by the germ theory, and to look to inoculation as a preventive.

A VERY INTERESTING FEATURE of the Washington experiment in manual training in the public schools, a brief account of which is given elsewhere in this issue of *Science*, is the great amount accomplished with a small amount of money. The sum available for the current school-year, aside from the salaries of teachers, was only five thousand dollars. With this, four carpentry-shops, two schools of cookery, and one turning, moulding, and forging shop, have been fitted up, the last with a steam-engine, shafting, etc.; and all the material used in them, and in the teaching of sewing to the girls in all the grammar grades, have to be paid for. The number of pupils, boys and girls, enrolled in the two higher grades of the grammar-schools in which it has been attempted to introduce manual training, and in the High School, was last year 3,807, and it is probably a little larger this year. The number of the pupils comprising the manual-training classes is 1,243. It is true that the most of these are receiving only one-half as much instruction as is desirable, and that a much larger amount of material could be used to advantage; but the fact that Superintendent Powell has accomplished so much with so small a sum proves that the expense of making an experiment in manual training in connection with the public schools, at which so many cities have hesitated, need not deter them.

THE PECUNIARY ECONOMY OF FOOD.

UNDER this attractive title there appeared in the January *Century* an article from the pen of Prof. W. O. Atwater, in which he propounded to the American people this question: —

"Is not the American, of all civilized men, the most wasteful, and is not his worst wastefulness in his food — and drink?"

This question comes closely home to nearly all classes; no more to the coal-laborer who made his boast, "No one can say that I do not give my family the best of flour, the finest sugar, the very best quality of meat," than to the affluent whose every desire can be gratified without pecuniary embarrassment.

Said a millionnaire to two young merchants, "If you cannot afford to eat mackerel, eat herring." Therein was hidden the secret of his success in acquiring fame and fortune. His wife was his co-laborer, a rigid economist, and yet she confesses her inability to overcome the wasteful habits of her kitchen servants.

Even those who preach the doctrines of Him who bade His disciples "gather up the fragments that remain, that nothing be lost," are wasteful.

A butcher in Philadelphia who has been supplying the laboring-class with meat for a number of years, informs me that five years ago there was a quick sale for all the cheap cuts, but now so universal has the habit become of buying the more expensive cuts, that there is no market in his neighborhood for low-priced meat.

A former president of the West Washington Market Association stated that it is the impecunious class that is most exacting regarding their meat-supply. They demand the most expensive cuts, while people in possession of an ample competency study economy in the purchase of their supplies.

In a neighborhood where the Scotch laborer predominates, I am informed that they buy the cheaper cuts, and make the most economical use of them, while the Irish in the same locality are universally wasteful. A gentleman formerly prominent in the Massachusetts State Board of Health, and of extended experience in studying all subjects connected with food, states that no greater truth has been uttered before the American people in recent years than that made by Mr. Edward Atkinson, that "if the people of this country would knock the bottom out of the American frying-pan, they would have one-third more money to spend for rent than they now have."

We plead guilty. Are not American dogs sleek and fat? Wherever there is a profusion of food, there you will find fat dogs; while in countries where the supply is scant, or where economy in food is compulsory, dogs are lean and hungry; for instance, as in Turkey.

We confess that there is, on the part of the average American and his imported allies, a prodigious waste of food, — in its purchase, its preparation and use.

> "O wad some power the giftie gie us,
> To see oursels as ithers see us!
> It wad frae monie a blunder free us,
> And foolish notion."

These lines prompted us to put the above question to a Frenchman, for many years master of the household of one of the crowned heads of Europe, a professional cook, a man of extensive travel, and at present, as for several years past, engaged in this country in the preservation and manufacture of food-products. And thus he replied: "Is there waste? Yes, in all directions. I never saw any thing like it. Tables are overloaded. There is too much of every thing. This waste is most notable at hotels, where it is so marked as to be ridiculous.

"You Americans seem to take very little pleasure at the table. You gobble up your food, or else take it as if it were medicine. Then there is no variety to the American table. A few articles are served day after day. Your *ménu* is the same everywhere, — beefsteak, ham and eggs, pork chops, sausages, pancakes, and pie. Last summer, in a trip to Bar Harbor, my daughter kept an account of the number of times beefsteak appeared upon the table, reporting upon her return that seventy-two times it was the main article served. In France the higher classes thoroughly understand the value of food. There is no waste, no loss in the kitchen. The clean remnants from the tables of the higher classes are purchased, overhauled, and sold in the market to the poorer classes, who waste more than the better, largely through ignorance. In France it is considered sufficient to serve one kind of vegetable with meat; but here in the United States, if four or five sorts are in season, you will be pretty certain to find three or four of them upon the table at once. Bad cooking is one reason for this great waste. The art of using the unsoiled remnants from a meal is not understood. These can be prepared in many ways, and so nicely disguised as to come to the table a second time in an attractive manner. Americans fail in this respect, because in the first cooking of meat it is overdone, so that, when subjected to a second cooking, it is made unpalatable. Faulty carving has also much to do with the universal waste of food."

Is this waste wilful? We are not prepared to answer affirmatively, or to indorse the statement that Americans are indifferent, and manifest an aversion to food-economizing. Waste may be, as claimed, epidemic in the United States; but it is not so through universal ignorance, although a portion of it may be so charged. That seems like a libel on the thrift and industry of the early settlers of New England, whose work and influence are felt throughout the United States. In new countries, where the reward of industry is unusually liberal, time is of great value. In Australia, where fortunes are made quite as rapidly, if not more so, than in this country, there has been a prodigious waste of food. There, as well as here, time is of greater value than in continental Europe.

There is no true economy in saving twenty-five cents' worth of nutriment when the time it requires is worth in other directions a greater sum. Many waste food because they will not or can not take the time for the proper preparation of the cheaper sorts. To make the most economical use of food requires time and trouble. It is easier to broil the toothsome sirloin or porter-house than to boil or stew some cheaper cut. We find that the wife of the coal-laborer who furnished his family the best of every thing on seven dollars a week, "had to cook before six in the morning, or after half-past six at night, because she worked all day in the factory." Her time was worth more in the factory than in the home. This probably accounts in some measure for the waste on the part of wage-earners, the balance being attributed to ignorance, or, as Professor Atwater puts it, "innocently committing an immense economical and hygienic blunder."

This waste, so common to Americans, seems an anomaly in view of the fact that in every direction the laborer is taught by the capitalist that it is only by the most rigid economy that profit is gained. Thus we find that a huge monopoly, as the Standard Oil Company, is constantly demonstrating to its laborers that ninety per cent of the crude oil received is manufactured into products having a commercial value. In the large hog-slaughtering houses throughout the United States, it is said that every thing connected with the hog except the squeal is saved. In the large abattoirs even the blood is saved, and utilized for fertilizing purposes.

It is by giving a commercial value to the little things which a few years ago were wasted, that large corporations are enabled to pay dividends. And yet, with this economical lesson constantly before all wage-earners, there goes on an enormous waste of food. The capitalist who enforces economy in his factory is in his house as much a sinner as his uneducated workman. Can it be accounted for in any other way than that time in the United States has a greater value than in any other country, and that at this period of our history it is worth more in other directions than in demonstrating the pecuniary value of food? That eminent student of economic science, Mr. Edward Atkinson, says that nowhere else are the products of labor and of capital so adequate and so ample as in the United States, and that nowhere else are wages and profits so high.

"Necessity is the mother of invention," and therefore we believe that when time is of less value in the United States than at present, and there is greater necessity for economy in the use of food, the average American will lead in getting the maximum amount of proteine at the minimum of cost.

This waste can be and is being checked. It is not as great as it was twenty years ago. The press fairly teems with books and journals devoted to household economy. There is an enormous demand for this sort of literature, so great that every newspaper devotes space to the subject. Through these mediums, the cooking-school and the instruction in cooking in the public schools, the

people, and especially the rising generation, are being taught the pecuniary value of food. The mass of the people do not realize the extent of waste now going on. It can be more fully brought to their attention when the pulpit seconds the press, and the preachers themselves learn the pecuniary value of food, and urge it upon those to whom they minister. When we are taught that it is sinful to waste, we shall be more apt to imitate the French, and have a greater variety of food, at less expense, with more leisure for the economical housewife.

Since 1865 the United States has led all other countries in the preservation of food in hermetically sealed tins. Every variety of soup, meat, fish, poultry, game, fruits, and vegetables is available at any season of the year.

The people are very rapidly learning "the pecuniary economy of such food" as compared with a like quantity of the same articles in a fresh condition. For instance: a one-pound can of the finest salmon in the world, packed on the Columbia River within a few hours of the time the fish is captured, costs the consumer 20 cents. He is thus enabled to secure nutrients at a cost of 55 cents per pound, which in fresh salmon at 35 cents per pound, as ordinarily obtained in city markets, would cost $1.40 per pound. Until recently this has been appreciated to a far greater extent in England than here. In this country, five years ago, there were consumed 16,000,000 tins of salmon. Since then each year has recorded a rapid increase in the quantity used, until last year 24,500,000 tins, or more than one-half the supply, were taken for home consumption. England is the chief buyer of American tinned meats, simply because consumers at home do not fully realize that a greater amount of nutriment for a given sum can be obtained in that way than from a like quantity of fresh meat at a far greater cost.

The waste of Southern cotton-fields is now being transformed into wholesome and cheap food, and destined, as W. Mattieu Williams believes, to take the place of lard as a frying-medium. We need not further specify in order to prove, that, as a people, we are making progress in the direction of checking waste, and that as population becomes more dense, time of less money-value, and the necessity for economy greater, we shall master the full meaning of 'the pecuniary value of food.' F. N. BARRETT.

ST. PETERSBURG LETTER.

RUSSIAN chemical literature has been enriched this winter by two considerable works, though of unequal value, — Mendeleef's work on solutions, and Menschutkin's 'Essay on the Development of Chemical Theories.' In the former book the celebrated Russian chemist gives a considerable account of his own work, together with a clear exposition of the views of other chemists. I cannot attempt to analyze it here, but mention only that he formulates some simple laws in this matter, which will undoubtedly be accepted by the scientific world. Menschutkin's book leads us from the phlogiston theory to the views of the present generation of chemists. The last chapters are the best. The author has for some years been engaged in the arduous task of measuring the time and other conditions of chemical re-actions. The second edition of Beilstein's 'Handbuch der Chemie,' published, like the first, at Leipzig, is rapidly advancing. Though rather a compilation, it is an exceedingly useful book, and it is scarcely credible that it should be the labor of one man. The author has been for more than twenty years professor of chemistry, and director of the chemical laboratory of the Technological Institute at St. Petersburg.

Professor Mendeleef received a short time ago an official mission to the Donetz coal-basin. The mine-owners petitioned for it, representing that his work on the petroleum question proved him to be equally competent in the scientific and economic aspect of it.

Russia has to deplore the early death of a man who has already done much for science, and could be expected to do more, — the zoölogist M. Bogdanow, professor of zoölogy at the University of St. Petersburg. Born in 1841, educated at the Kazan University, where he finished his studies in 1864, he came to St. Petersburg in 1871, and remained professor till his death, March 16, 1888. Mammals and birds, and their geographical distribution, were his principal studies, especially the latter. His two greatest works are, 'The Birds of the Caucasus,' published in 1885; and 'Russian Ornithology,' the first part of which appeared in 1885. He travelled extensively, especially in eastern Russia, the Caucasus, and to Khiva and the surrounding deserts, and gave some of the best descriptions of these countries to be found anywhere. For some years he was very much interested in economic zoölogy, especially in the breeding of domestic birds. As professor he was exceedingly popular, and some of his pupils have already done good work.

The results of the past 'geographical campaign' were not brilliant, as no first-class geographical expedition was in the field. It is to be hoped the current year may give more. General Prejevalsky is here, and hopes to start again for Tibet in August or September, 1888, to equip the expedition, buy camels at Karakol, near Lake Issyk-Keel, and then go via eastern Turkestan. A money-grant from the government will certainly not be refused for his expedition, on account of the high scientific character and political importance of the former.

He has brought with him the manuscript of the narrative of his fourth journey, which is soon to be published. As to the special reports on botany, zoölogy, etc., they are in the hands of specialists, and some of them will take considerable time.

Potanin is now at Irkutsk, having accepted the position of secretary of the East Siberian branch of the Russian Geographical Society. He is occupied in writing the report of his last extensive journey to western China, Mongolia, etc., and is not likely to start very soon on a new expedition.

As to the work of the Russian Polar Commission, the report on terrestrial magnetism at Sagastyr, at the mouth of the Lena, will soon be issued, while the additional observations will not be issued until some years later. The reason is, Lieutenant Jurgens has been ordered to embark for Vladivostok, and will have no time for the discussion of the Sagastyr observations for two or three years.

The council of the Imperial Russian Geographical Society have decided to grant money for the fall expedition in 1888: Kousnezow to the northern Caucasus, Kossikow to the south-western Caucasus. Both will study the glaciers. The latter goes principally for studies on mammals and birds. Adrianow will go to the Altai, Colonel Grombtschewsky to the Pamir, Listow to the Crimea, where he did good work in 1887. An expedition which is not entirely decided upon is that of the astronomer Baklund, and geologist Kudriawtsew to the Kola Peninsula. The geologist Iwanow, well known for his explorations of the Pamir, is to start in a few days for Vladivostok, for a two-years' exploration of the vicinity, the Sichota-Alin Mountains, and southern part of the Ussuri basin, the principal aim being the discovery and exploration of coal-mines.

The Meteorological Commission of the Geographical Society is doing good work, and now organizing some stations which will make observations which may be useful to agriculture; viz., actinometric, and on the temperature of the soil from the surface to a depth of two metres. The most interesting of these stations is that proposed at Sultan-Bend, on the Murghab River, south of Merv, where a great dam is to be built across the river, and the water retained to irrigate 300,000 hectares of the most fertile land. Extensive cotton-culture is contemplated on the land thus redeemed from barrenness, as in that country no culture is possible without artificial irrigation.

The depression of agriculture and low prices are the topic of the day, and often discussed in more or less learned societies; but it would be difficult to give a brief account of them, and most of the discussion is of no scientific value.

The season from January to the middle of March has been a rigorous one also in the north of Russia. The frosts were remarkable for their persistency more than for their rigor. From the 7th of January to the 22d of March there was no thaw at St. Petersburg, yet the air-temperature did not sink below —29° C. It fell much lower in February, 1867 (—33.5°); January, 1868 (—38.0°); February, 1871 (—36.3°); and December, 1876 (—37.6°). It sank below —30° even in March, 1867 and 1877.[1] For many days in January, February, and March the coldest region was southern and central Finland, the cyclones passing south of it. Thus in the north we did not have the fearful snow-storms which were experienced nearer to the centre of the cyclones in central and southern

[1] In all these cases not the minimum temperature, but the lowest of those observed by observations made thrice a day, are given.

Russia as well as in Germany, where traffic was blocked for many days. Now it is often stopped on account of the melting of the enormous amount of snow accumulated in winter. Destructive floods have already begun, especially in Hungary and Galicia, and will extend northward and eastward as the season advances.

O. E.

St. Petersburg, April 2.

SCIENTIFIC NEWS IN WASHINGTON.

Manual Training in the Washington Public Schools. — Dr. Sternberg's Investigations in Regard to the Yellow-Fever Micro-Organisms. — Production of Copper, Lead, and Zinc.

Manual Training in Washington.

A YEAR ago Congress appropriated five thousand dollars to be used during the present fiscal year for the experimental introduction of manual training into the public schools of Washington, in accordance with a plan outlined by Prof. W. B. Powell, superintendent of schools of the District of Columbia. Industrial drawing had been introduced into the schools six or eight years ago. Beginning with moulding in clay and stick-laying and the study of the forms represented, the pupil is advanced, during the eight years of the course below the High School, to constructive drawing, free-hand and instrumental; to making working drawings of the hollow cylinder, of the bolt-head, of the bell, of the pulley, of the try-square, and of framing (the mortise and tenon); to the making of conventional ornaments, drawing plant-forms from nature and adapting them to ornament, etc. Professor Powell's plan was to supplement this by making work in shops a part of the regular course for the boys in the two higher grades of the grammar-schools and in the High School, and in the same way to ingraft instruction for the girls in cookery, upon the same grades.

With the funds provided by Congress there were fitted up, at the beginning of the present school-year, two schools of cookery, four schools of carpentry, one school of turning, moulding, and forging, and one school of sewing. The cost of furnishing and equipping each school of cookery with chairs, table, washstand, cupboard, dishes, range, boiler, and fittings, was $202.20; that of each school of carpentry, for benches, tools, lumber, and nails, a little less than $400; and that of the school of turning, moulding, and forging, including moulding tools, forges, lathes, and tools for same, shafting, belting, pulleys, and fittings, and steam-engine, $1,800.29. The estimated cost of materials for all of these schools for the current school-year, the estimate being based upon the actual expenditure to Jan. 1, is $631.53. Eight teachers are employed, — two of cookery at $500 a year each; four of carpentry and one of turning, etc., at $650; and one of sewing at $700. The teachers of carpentry, turning, and forging are all graduates of the Worcester (Mass.) Polytechnic Institute, specially trained to give this kind of instruction; and the teachers of cookery are graduates of the Washington Normal School, who have taken a special course in cookery under the supervision of Superintendent Powell.

The number of pupils now under instruction, drawn from the seventh and eighth grades of the grammar-schools and from the High School, is as follows: in the schools of cookery, 471; in the schools of carpentry, 660; in the school of moulding, turning, and forging, 112; in the school of sewing, 600. These schools, except the sewing-school, the instruction in which is given in the regular classrooms, are divided into classes of about twelve pupils each, which succeed each other during each school-day at intervals of one hour each. Every class, therefore, has one hour's instruction in the shops each week. It is Superintendent Powell's desire to increase this to two hours a week as soon as sufficient funds are available, and shops have been provided for all the pupils in the grades mentioned. In the cooking-schools, each lesson consists of instruction in the chemistry of foods and cooking, in the relative nutrient qualities of different articles, in the selection of food at the markets and the groceries, and in the practical preparation of one dish. During the week intervening between the lessons, the pupils are requested to make a trial of the dish last made, and to report success or failure.

The interest of the pupils in this work is very great. The teachers have been surprised to find how many of the girls in the two higher grades of the grammar-schools and in the High School are entirely ignorant of even the plainest cooking. This is true not only of the daughters of wealthy parents, but of those of families of small income, like clerks in the government departments. In a large majority of cases no instruction at home seems to have been given the girls in the public schools. Again: the more wealthy parents are, as a rule, the more anxious that their daughters shall join the classes in cookery. Some of the pupils at first objected to washing the dishes and making the kitchen ready for the next class, but this false pride has already disappeared. A healthy emulation has sprung up among the girls of each class to be able to report the most successful experiments in cookery at home; and in many a family in Washington an improvement in the methods of preparing food has already taken place, as a result of the few months' instruction that has already been given.

The schools of carpentry are also divided into classes of twelve pupils each, and the course comprises two years' instruction. During the first year the boys in the seventh and eighth grades of the grammar-schools are practically taught the correct methods of using planes, handsaws, chisels, gouges, brace and bits, hammer, gauge, and other tools in the working of wood; the laying-out of work with knife and pencil, using try-square, bevel, and dividers, and working from drawings executed by the pupil himself; the making of plain and more complex mortise-and-tenon joints; dove-tailing and plain cabinet-making; the making of articles of practical utility for the schools and shops; the putting-together of work with brads, nails, screws, and glue; the care and sharpening of edged tools; and the use of circular saws.

A visit to the schools of this grade showed wonderful progress during the few months since they were established, and this progress was especially striking when some of the earlier work was compared with some of the later. In one of these schools, each pupil was engaged in making a shoe-blacking box. The designs were all original, and no two of them were alike. Some of them showed considerable invention in the form and arrangement of the boxes. Working-plans had first been made, and submitted to the teacher for his approval, and every pupil was required to construct his box in accordance with the plans submitted. The work was well advanced when seen; and some of it would have been highly creditable to a skilled cabinet-maker, while the average of it all was certainly as high as that which would be done by the average Washington mechanic. Benches for use in the shops, shelves and cupboards for the use of the schools, geometrical blocks for the primary schools, and many other articles, had already been made by the classes of this grade.

In the turning, moulding, and forging shop the boys from the eighth grade of the grammar-schools and from the High School are taught the use of all the hand wood-turning tools, embracing plain and fancy turning in hard and soft wood, inside and outside; the use of chucks and face plates; pattern-turning; bench-moulding in sand; casting soft metal, embracing the use of slickers, trowels, riddle, etc., using patterns made by the pupil himself; the forging of small articles of soft iron and steel, and steel tools, with instruction in the simpler methods of manufacture of iron and steel; practice in welding iron and in hardening and tempering steel, and by lectures on metallurgy.

It is the intention to give each class two hours of practical instruction a week; but, owing to the small number of shops and the limited number of teachers, they are receiving but one hour a week this year. But their progress has been very satisfactory. The work in turning, moulding, and forging, while showing great differences of adaptability on the part of the pupils, proves that every boy is capable of learning to use common tools, and of making with them a thousand and one articles which, before the few lessons he has received, he would not dream of undertaking. Among the useful articles already made in this shop are a set of filter-stands for the physical laboratory of the High School, handles for tools, etc.

The interest of the boys in the work of the shops is as great as that of the girls in cookery. They are all bright, wide awake, and there is no listlessness, no idling the time away. As all the members of each class are engaged upon similar work, there is a healthy emulation among them to produce the best results. It is also noticeable that the wealthier parents take more interest in these

shops than those in more moderate circumstances, and, as a rule, desire that their sons shall have the manual training, even though they intend to enter professions.

What is claimed for the Washington experiment is, that it is an attempt to ingraft upon the common schools a system of manual training that shall give to all the boys a practical knowledge of the use of the most common tools used in working in wood and iron, and to all the girls a similar knowledge of plain cooking and sewing. This it is intended to do without interfering with the regular studies; each class, when the schools are completely organized, devoting two hours a week to the manual training.

The shops in Washington have not been established long enough to make it possible to determine whether the experiment will be successful or not. The only thing that can be said of it is that the results thus far seem to be encouraging. Of the single school of carpentry established in the High School last year, and attended by 225 pupils, Superintendent Powell says, "The work was successful. It was not difficult to manage it with the other regular courses of study of the school. The boys seemed to like the work, and showed no disposition to withdraw from the class. Although but one hour's instruction per week was given each pupil, a marked improvement in the use of tools was noticed; and it is known that many boys did corresponding work at home for practical and useful purposes, which was furthered at least, if not induced, by the training and suggestions received at the school shop." The late principal of the High School, in his annual report of the first year's instruction in carpentry, said, "It is certain that it did not hinder the general progress of any boy engaged in it, and it is equally certain that the influence of the work was beneficial in various ways in the school."

Superintendent Powell recommended an appropriation of ten thousand dollars for manual training in the Washington schools for the next year, and it is probable that eight thousand will be granted. This will make it possible to increase the number of schools of cookery and of the shops, and to provide additional instruction. Opportunities will thus be provided for all the pupils of the highest two grades of the grammar-schools and of the High School, and probably the number of hours of instruction can be increased from one to two hours a week for each class.

The Yellow-Fever Germ.

Something more than a year ago it was positively announced that a Mexican physician had discovered the yellow-fever germ; that it could be cultivated; and that, by inoculation with it, human beings could be rendered unsusceptible to the disease. Subsequently a similar report was received from Brazil, and together they caused wide-spread discussion both in this country and Europe, not only in the medical journals, but in the popular press. So important was this matter considered in Washington, that the President determined to have a special inquiry made in regard to it, and Dr. George M. Sternberg of Johns Hopkins University, a man of large practical experience with fevers, was appointed to make it. He visited Mexico and Brazil; and, although he has not yet submitted his official report, he obtained permission to prepare and read in advance of it a paper on the subject, setting forth in a general way the results of his inquiry. This paper was read before the College of Physicians, of Philadelphia.

The amount of time accorded Dr. Sternberg not only prevented the investigation from being as thorough as was desirable, but it made it necessary for him to visit Brazil in June, which is in the winter season south of the equator, and Mexico in September, when there were comparatively few cases of yellow-fever. His opportunities for observation, therefore, were not as good as could be wished. But his inquiries did go far enough to justify him in saying that he found really nothing to sustain the sanguine expectations of the Mexican and Brazilian scientists. Such examination as he had been able to make in Havana, Vera Cruz, Rio Janeiro and other Brazilian ports, which had yellow-fever, had not discovered any such micro-organisms as these gentlemen say they have found. These investigations were not confined to the blood alone, but to the alimentary canal and other parts of the digestive organs, and were extended also to the muscles and other tissues.

In order to show the exact degree of success in preventing yellow-fever by inoculation, Dr. Sternberg said that out of 44 inoculated in Rio Janeiro, 22, or 50 per cent, had been seized with the disease; and of these, 9, or 40 per cent, had died. "This is important," observed Dr. Sternberg, "when taken in connection with the usual rate of mortality, which is 30 per cent, as showing, that, so far from being a protection, inoculation increased the effects."

Dr. Sternberg said that in his official report to the government he had laid stress upon the fact that certain experiments which ought to have been carried out were rendered abortive by his having to return to Washington in accordance with his official orders. Under these circumstances, he had thought it best to advise that the investigation be continued by means of autopsies and with the blood taken from the living patient. In accordance with this recommendation, the President had directed him to continue his inquiry. So far as a practical analysis of the blood of the subjects referred to by the Mexican and Brazilian doctors was concerned, he had failed to find any such condition as they had described. At the same time further experiments ought to be made, although he had found no evidence to prove that the Mexican and Brazilian doctors had solved the problem of preventing yellow-fever by their inoculation and microbe theories.

Copper, Lead, and Zinc.

Prof. David T. Day, geologist in charge of the Division of Mining Statistics and Technology, of the United States Geological Survey, has issued a preliminary statement of the production and consumption of copper and of the production of lead and tin in the United States for the year 1887. The production was as follows: —

	1885. Pounds.	1886. Pounds.	1887. Pounds.
Domestic copper	165,875,766	156,735,381	177,420,524
From imported pyrites and ores	5,086,841	4,500,000	3,750,000
Total	170,962,607	161,235,381	181,170,524
	Short Tons.	Short Tons.	Short Tons.
Desilverized lead	107,437	114,829	135,552
Non-argentiferous lead	21,975	20,800	25,148
Total	129,412	135,629	160,700
Spelter	40,688	42,641	50,340

It is very difficult to secure trustworthy statements of stocks of copper in producers' and dealers' hands, and *in transitu*, and therefore Professor Day has adopted the plan of obtaining statements from the consumers of the country of the amount of copper used by each for a series of years. Answers were received from every brass and copper mill and from every brass foundery of any consequence in the country. The consumption of the copper and brass rolling-mills and wire-drawers was, in 1885, 51,110,522 pounds; in 1886, 63,921,217 pounds; and, in 1887, 72,521,287 pounds. The brass-founders used, in 1886, 8,146,866 pounds, which rose to 9,822,731 pounds in 1887, — an increase of 20.5 per cent in one year. Adding the two series of figures, a total consumption is reached of 82,344,018 pounds in 1887, as against 72,068,083 pounds used in 1886 by the same establishments, — an increase of 14 per cent. Professor Day reaches the conclusion, therefore, that the copper-consumption of the United States has been generally overestimated, and that in 1887 it was not much, if any, in excess of 100,000,000 pounds of new copper.

ELECTRICAL SCIENCE.

Intensity and Consumption of Different Sources of Light.

THE following are results of careful measurements, the unit being a standard English candle. The tables are summarized.

Petroleum Lamps.

A number of different lamps were used. The general result was

that all the forms had about the same efficiency. The consumption of oil is about 4.5 grams per candle-power per hour.

Gas-Burners.	Candle-Power, Mean.	Cubic Feet per Candle-Power per Hour, Mean.
Ordinary fishtail	17.	.523
Argand	20.5	.410
Auer's incandescent	12.5	.290
Siemens regenerative No. 3	66.	.260
" " No. 1.	172.	.350
Wenham No. 2	40.	.230
" No. 4	181.	.160

The argand burner is better than the fishtail: the latter uses nine cubic feet per hour instead of five or six, as is usually calculated, although this is largely a matter of local condition. The Auer incandescent lamp uses only half the gas that the fishtail consumes, but the deterioration of the incandescent material must be added. Of the high-candle-power lamps, the Wenham is most economical.

Arc Lamps (Electric).

	Mean Candles.	Mean Candles per Horse-Power.
Piefer	250	900
Piette-Krizik	820	1,090
Seimens	2,200	1,330

Incandescent Lamps.

	Mean Candles.	Mean Candles per Horse-Power.
Edison (old type)	16	122
" (new type)	16	147
Swan (old type)	16	133
" (new type)	16	157
Siemens	16	169
Bernstein	16	157

Magnesium Lamps.

These consist of a small clock-work which gradually unrolls the magnesium ribbon, and advances it through the centre of a reflector at a rate which can be regulated to equal that of consumption. From one to eight ribbons can be used. A ventilator is provided for the escape of the fumes produced by the combustion of the metal.

No. of Ribbons.	Candles.	Consumption per Hour per Ribbon for 100-Candle Power.
1	3,200	11.14 grams.
2	5,880	14.10 "
4	8,000	14.80 "
6	11,300	14.15 "
8	17,000	14.03 "

The price of the ribbon is nearly five dollars a pound, and this will make the price of one hundred candles per hour sixteen cents. This lamp can be improved, and the price of magnesium will probably fall.

A NEW ELECTRIC METER. — Prof. R. Boernstein of Berlin has invented a new form of current-meter for measuring the amount of current used at points of consumption. It consists of a compact electro-dynamometer whose indications are proportional to the intensity of the current, combined with a planimeter for integrating the deflections. The registering-apparatus is attached to a vertical wheel, which turns by the friction of a horizontal wheel driven uniformly by clock-work, which it touches. As the vertical wheel is nearer to or farther from the centre of the horizontal wheel, its velocity of rotation is less or greater, and its position is governed by the deflection of the dynamometer, being nearer the centre for a small, farther for a large, deflection. The apparatus is compact, and is said to measure to one-half of one per cent: it can be used for both direct and alternating currents. In case the necessity of winding the clock-work were an objection, it would be easy to accomplish this by a small motor that would be thrown in circuit when the spring was uncoiled to a certain amount.

THE RADIOGRAPH. — M. Louis Oliver proposes, by an application of Crooke's radiometers, to measure the total amount of light falling upon the vanes, the record having reference both to the time and intensity of the light. As the vanes of the radiometer revolve, they make contact with a wheel, closing an electric circuit. The wheel form of contact is adopted, as it offers very little resistance to the motion of the vanes. The current closes a relay, bringing into action a more powerful current, which moves the needle of a step-by-step apparatus across a scale. If the instrument is constant in its action, and fulfils the expectations of its inventor, it may be useful for photometric purposes, measuring the number of rotations in a given time.

STORAGE-BATTERIES ON THE BRUSSELS TRAMWAYS. — There have been lately reports of the failure of the storage-batteries on the tramway in Brussels that is experimenting with them. It is said that the deterioration of the batteries has been as much as seven cents per car-mile; and at that price they cost more than horses. The company supplying the batteries has come forward with the statement, that, since they delivered the cells, they have never been consulted in any way, and that their directions have not been complied with. It has been pointed out in this journal, that while in many cases storage-batteries will to-day be cheaper than horses, yet this will only be true when they are supplied at moderate cost, and when the facilities and cost of renewal are reduced to a minimum. At the same time, the cost of the batteries in Brussels is more encouraging than otherwise; for, at seven cents per car-mile for depreciation, the cost will be only slightly greater than that of horses, and the increased speed and comfort will more than compensate for this. The total cost for horses may be roughly estimated at ten cents per car-mile for an ordinary car in our Eastern cities. At seven cents for depreciation, the cost of batteries will be something under eleven cents per car-mile. With the advantages electricity offers, even this should throw the balance in its favor; and the calculation is on the most unfavorable data obtainable.

THE EICKEMEYER DYNAMO. — This dynamo differs from the ordinary type in that the field-magnet coils are wound close around the armature, with a heavy shell of iron outside. The object is to concentrate the lines of force where they are most needed, — through the armature, — and to prevent magnetic leakage. It makes a compact machine, which should give considerable output for its weight. The principle of the 'ironclad dynamo,' such as is embodied in Mr. Eickemeyer's invention, has been claimed by a number of inventors. Whether Mr. Eickemeyer was the first to construct such a machine or not, he seems the first one who has made it a practical success.

AN IMPROVED PRONY BRAKE. — In an ordinary Prony brake, in which the work of a machine is absorbed by the friction of its pulley between two clamps fitting over it, and where the power is calculated from the moment of the force tending to turn the clamps, and the revolutions of the pulley, there are many difficulties. The friction between the clamps and the surface of the pulley varies from different causes, — changes in lubrication, change of pressure due to heating, etc., — and the readings are most irregular. M. E. Meylan has described a new form of brake, simple of use and construction, that will measure with considerable accuracy powers

from five-horse power upward. The improvement consists in an automatic arrangement by which the pressure between the clamps is adjusted to compensate for irregularities in lubrication, etc. The two clamps are connected by a system of levers, so arranged, that, if there is a tendency for the whole system to revolve in the direction of revolution of the pulley, the pressure between the clamps is decreased; if it begins to move in the other direction, the pressure increases. This seems a great improvement over the ordinary Prony brake, and will be useful in measuring the efficiency of steam-engines, large electric motors, gas-engines, etc. It cannot, however, replace transmission dynamometers for many purposes, and it is probably not so efficient as the best of the latter class; the Tatham dynamometer, for example. It is an instrument that can be cheaply made, and no doubt will be extensively used.

HEALTH MATTERS.

Cholera-Infantum and the Weather.

AT a meeting of the New York Academy of Medicine, held in February, Dr. A. Seibert read a paper on cholera-infantum and the weather. The frequency and fatality of this disease in this latitude during the summer months make this subject one of great interest. Dr. Seibert includes under the name 'cholera-infantum' all cases of acute gastro-intestinal catarrh in children under five years of age. The basis for this paper was an experience of ten years (1878 to 1888) in the children's department of the German dispensary of New York City, during which time 8,036 cases of gastro-intestinal catarrh had been treated. The disease exists all the year round, even in the coldest weather; and the proportionate mortality, one in four, is just the same in cold as in hot weather. This he claims is shown not only by his own statistics, but also by those of the board of health. The largest number of cases, however, occurred during the summer months. Thus, in the ten Julys there were 2,443 cases, and in the ten Augusts 1,524 cases, while in the ten Februarys there were only 117 cases. The number of deaths was always much greater in July than in August. Thus, during the ten years, the number of deaths reported in the city of New York in the month of July was 12,428, and in August only 6,205. In July, 1881, when the mean temperature was 80°, the number of cases treated in the dispensary was 290; in August of the same year, when the mean temperature was 82°, the number of cases was 223; and in September, when the mean temperature was 87°, the number of cases was 137. During the summer months it was found that the number of cases and of deaths bore no relation whatever to the rise and fall of temperature, and the same was true as regards the range of humidity; so that warm, moist weather did not predispose more to the disease than warm, dry weather. No relation could be demonstrated between the prevalence of the disease and the rainfall, and the same was true in regard to the velocity of the air-current. According to prevalent opinion, the months containing the greatest number of hot days ought to have had the greatest number of cases and of deaths; but there was no evidence supporting this. It is evident, Dr. Seibert thinks, from the facts, that *hot* weather is not necessary for the production of the disease, but that *warm* weather is. Statistics show that in the early part of the summer season, as soon as the minimum daily temperature remains above 60° for a number of days (a week or more), the disease becomes epidemic; and this, no matter how high above 60° the temperature may go, whether it is 75°, 80°, or 85°. His conclusions are as follows: First, Hot weather, either dry or moist, is not necessary for the epidemic appearance of acute gastro-intestinal catarrh; Second, Warm weather, either dry or moist, showing a minimum daily temperature of not less than 60°, brings on the epidemic every year, irrespective of the height of the maximum daily temperature; Third, The disease loses its epidemic character as soon as the minimum daily temperature falls below 60°, as in October; Fourth, Therefore this disease cannot be brought about by the direct effect of high temperature upon the child's body.

Dr. Seibert then went on to say that the lowest temperature of each day was reached during the night; and it was at this time that the milk which furnished the principal food of so many young children was brought into the city. It was often carried long distances, being much jolted about, and absorbing impurities from the time it left the cow: it was therefore only a question how far the decomposition of the milk had advanced by the time it reached the child. It was well known that a low temperature retarded decomposition; and Dr. Cyrus Edson, of the New York Health Department, had informed him that in his experience he had found that milk usually began to turn whenever its temperature reached 60° or higher. Chief-Engineer Birdsall, of the Department of Public Works, had also informed him, that, whenever the temperature of Croton Lake rose to 60° or above, there was a peculiar taste about the water, which he attributed to the decomposition of certain matters contained within it.

As to the point why there are always so many more cases and deaths in July than in August, the difference usually amounting to at least one-third, it seemed to him that it might perhaps be explained by the fact that it took a few weeks after the onset of warm weather to fully arouse the tenement-house population to the danger to which their children were exposed from this disease, and to the necessity of taking suitable precautions as regards fresh air and diet for its prevention.

In the discussion which followed the reading of the paper, Dr. L. Emmett Holt referred to some statistics of Liverpool which tended to confirm some of Dr. Seibert's conclusions. In one year 347 deaths occurred from cholera-infantum in July, the average temperature being 58.9° F., while in August, when the temperature was 59.2°F., there were 969 deaths. Dr. Holt said that in summer there were different forms of diarrhœal disease in growing children, and that he thought it was advisable that some distinction should be made between them. In the production of what is ordinarily known as 'summer-complaint,' he believed that there were four principal factors concerned, — namely, heat, feeding, sanitary conditions, and constitution, — and that the most important of these features was heat.

Dr. J. Lewis Smith thought that there was perhaps a fallacy in comparing summer diarrhœa with that of winter; the two being, in his opinion, very different diseases. He believed that summer-complaint was due to heat, but just how this acted was not yet known. Heat alone is not sufficient, else the disease would be prevalent in the country as well as in the city. How much gaseous exhalation had to do with its production was not ascertained. The opinion is gaining ground that summer diarrhœa is a microbic disease. It was well known that milk which had begun to decompose had a tendency to give rise to the affection. In Asiatic cholera the causative agency of Koch's bacillus had been pretty generally accepted, and it was believed that this microbe was received into the mouth, and acted as a source of irritation to the intestines by its actual presence, and not by causing decomposition of food. In like manner it did not seem unreasonable to suppose that micro-organisms might act in the same way in some cases of summer diarrhœa.

Dr. A. Caille thought that decomposing milk was the chief exciting cause, while a high temperature paves the way. Two French physiologists had made some experiments by exposing animals to a continual temperature of 104°, and the phenomena which they observed to result from the exposure were: (1) increase of nervous excitability; (2) nervous depression; and (3) convulsions, coma, and death; death resulting more speedily in a moist high temperature than in a dry high temperature. The same results had been noticed to be produced in children when the weather was very hot. It was his opinion, therefore, that while high temperature did not directly produce diarrhœa, it did have a pernicious effect upon the system, and under these circumstances any irritating substance would be likely to give rise to diarrhœa.

As regards the smaller number of cases of summer-complaint, as well as of deaths from the disease, in August than in July, he thought that perhaps one reason for this was that a much larger number of children left the city in August than in July, while those which remained had the advantage of the numerous fresh-air excursions then provided for the poor.

Dr. A. Jacobi said that the cases which occurred were not all alike. In some there was a simple catarrh, in others a tendency to collapse. He thought that great heat would kill by its direct effect on the heart, the myosin of the muscular tissue of that organ being coagulated by the heat. Intense heat would cause a dilatation of

the blood-vessels of the surface of the body, and deficient nutrition of the brain would result, and collapse. These were the fatal cases among both the rich and the poor.

WASTED SUNBEAMS; UNUSED HOUSETOPS. — In a recent number of the *New York Medical Record*, Dr. Gouverneur M. Smith makes some extremely valuable suggestions in an article entitled "Wasted Sunbeams; Unused Housetops.' He says that human habitations, though erected for the benign purposes of insuring comfort, affording protection, and promoting family privacy, are, unfortunately, often the causes of a number of the morbid ills from which mankind suffers. This fact is true, as relating to the residences both of the rich and of the poor. It is a difficult task to construct an absolutely sanitary dwelling. In nearly every house, however, there are more or less avoidable insalutary conditions, which are undermining the health of each family circle. After describing the advantages of tent-life, and the benefits which accrued to those who lived most of the time out of doors, he goes on to speak of the incompatibility of such a life with the demands of a civilized race, and a rigorous climate. History tells us that certain nomadic tribes in the early ages, finding aggregation and permanency of residence desirable for business and other purposes, built solid structures, and, striking their tents, henceforth dwelt in substantial residences. While the early Orientals had but little knowledge of the exact nature of air and sunlight, they nevertheless believed that fresh air was an important factor in maintaining physical vigor, and that exposure to the solar beams was salutary. In constructing their homes, their architects utilized their housetops, and gave them salubrious plateaus. The roofs, gently declining as watersheds, were covered either with tiles, bricks, or cement, makthem as durable as pavements. Beddings of turf, prettily distributed, made these artificial deserts to 'blossom as the rose.' Dr. Smith asks the question, "Is there any thing, either in our climate or state of civilization, which prevents us from, in a measure, imitating such ancient, useful, and fashionable airiness?" Our atmosphere is proverbially bright, and many of the severer days are sunshiny. In a great metropolis like New York there are thousands of children and invalids, to say nothing of those in mature years and engaged in the ordinary pursuits of life, who require more fresh air and sunning than is now practicable. City yards are small, shut in by tall buildings and high fences; the parks may not be adjacent; and the streets afford ill-conditioned pleasure-grounds. He suggests that it would be no difficult task for architectural ingenuity, assisted by sanitary science, to contrive some method of using the thousands of acres of housetops so that roofs, now so useful in affording indoor protection from cold, sleet, and rain, can be made additionally useful at certain seasons by affording out-door recreation and protection for invalidism. The 'solarium' of the New York Hospital, made attractive with its plants, birds, and aquaria, is a potent ally of therapeutics in restoring the convalescents, and at the Hospital for the Relief of the Ruptured and Crippled the contagious sparkle of the sunbeam is found shining in the eyes and lives of the young patients.

BOOK-REVIEWS.

Exact Phonography. By GEORGE R. BISHOP. New York, The Author (At the New York Stock Exchange). 12°. $2.

EVERY writer of shorthand has often had occasion to regret the imperfections of the best of the modern systems. Pitman's 'Phonography,' with the American modification of it, and one or two others, English and American, which are in the main attempted improvements upon it, are almost perfect as to the representation of the consonant sounds and their combinations, and, if one attempts nothing more than the 'corresponding style,' are quite as unambiguous and legible as fairly written longhand script. But while the 'corresponding style' may be written much more rapidly than longhand, it is impossible to attain sufficient speed in it to make it available for the uses of the reporter, or of the student, professional, or business man, who desires to use it for jotting down quickly notes of what he sees or hears. To adapt it to these practical ends, it has been found necessary in all the older systems to abbreviate, sometimes at the expense of exactness and legibility. Vowels have been almost entirely omitted, and indicated by the position with reference to the line of the ruled paper upon which the consonants are written; and as only three positions are used, while there are nearly twenty different vowel-sounds, it follows that the same character in the same position frequently represents three or four different words (in a few cases from six to a dozen). The context alone can show which of these words was intended, and the success of the writer in determining this at any future time will depend largely upon his knowledge of the subject treated of, or upon the tenacity of his memory. The prevailing systems of shorthand, also, fail when a great number of technical terms or foreign words or phrases are introduced, unless the terms, words, or phrases are those with which the reporter is familiar, and for which he has invented special contracted forms. Mr. Bishop, who is the stenographer of the New York Stock Exchange, has undertaken the difficult task of devising a system of shorthand in which, without sacrificing brevity and speed, all essential vowel-sounds shall be actually represented by written signs. His purpose is to leave little or nothing to the judgment or memory of the writer in transcribing. It is impossible, without making a practical trial of Mr. Bishop's 'Exact Phonography,' to determine to what extent he has succeeded. His system is certainly exact and unambiguous, and therefore easily legible, even in its most contracted forms; and it looks as though it might be written with as great speed as any of the older systems. Mr. Bishop calls his book 'A Text-Book for Self- and Class-Instruction.' It is certain that no previous new system of shorthand has been introduced to the public with so much fulness of explanation and wealth of illustration as 'Exact Phonography.' Every thing is made perfectly plain for the attentive student.

European Schools of History and Politics. By ANDREW D. WHITE. Baltimore, Murray. 8°.

IN *Science*, No. 253, we noticed the two interesting papers by Dr. H. B. Adams and Professor Fredericq on historical teaching in the United States and in England and Scotland. The present paper, by ex-President White, supplements these. It is the last issue for the year 1887 in the Johns Hopkins Series of Studies in Historical and Political Science. Most of Mr. White's accounts are based on his personal observation, and gain thereby much in value. On p. 11 we read, "As to the general character of all this instruction among German-speaking peoples, whatever it may have been in the past, it is not at present calculated to breed *doctrinaires*; it is large and free; the experience of the whole world is laid under contribution for the building-up of its students; questions of living interest have their full share in the classrooms. To know how our own democracy is solving its problems, one of the German universities sends to this country for study one of its most gifted professors, — one from whom thinking men on this side of the Atlantic have been glad to learn the constitutional history of their own country. The lectures of Professor von Holst, as delivered here, and his work upon the constitutional history of the United States, are sufficient to show that this instruction in the German universities is given in a large way, and is not made a means of fettering thought. At no seats of learning in the world, probably, is political thought more free. The University of Berlin stands in the main avenue of the capital of the German monarchy directly opposite the imperial palace. Within a stone's throw of the Emperor's work-table are the lecture-desks of a number of professors, who have never hesitated to express their views fully upon all the questions arising between democratic and monarchical systems. I have myself, in these lecture-rooms, heard sentiments freely uttered which accorded perfectly with the ideas of Republican and Democratic American statesmen." In a similar way the historical and political teaching in France is favorably commented on. The most valuable portion of the paper is that in which the writer applies the experience of Europe to ourselves, and points out what we should be doing in this direction, and how we may do it. It is an eloquent and able plea for broader and better historical and political teaching in our own colleges and universities. As an appendix to the main paper, there are printed 'Modern History at Oxford,' by W. J. Ashley; 'Recent Impressions of the École Libre,' by T. K. Worthington; and 'Preparation for the Civil Service in the German States,' by L. Katzenstein.

Practical Geography for Schools. By ALFRED HUGHES. Oxford, Clarendon Pr. 12°. (New York, Macmillan, 60 cents.)

THE present volume, which is the first part of a geography for schools, has for its object, not the explanation of geographical phenomena, for such is not given in any instance. The data of geography are considered as given and as explained, and they are used for the purposes of teaching geometrical drawing, arithmetic, and the elementary ideas of geometry. By this method the author hopes to impress the data of ordinary descriptive geography, by constant use, upon the mind of the pupil. The book deals only with mathematical geography, and many examples are given for computing distances between two places, differences of time, altitudes of the sun and of stars. As for these purposes the latitudes and longitudes of places must be known, the pupil will acquire by practice a considerable amount of knowledge in this line. But, although this may be true, we cannot recommend the author's methods. We assume that the book is not intended for teaching geography, as it does not try to prove any of the facts that are mentioned in it. The geographical problems of mathematical geography are far too difficult for boys. The author recognizes this fact, and claims as an advantage for his methods, that little or no mathematical knowledge is necessary before children can master all the methods explained in his work. But this advantage is reached only by an extreme laxity of definitions, and by applying wrong geometrical proofs: therefore the pupil will have to unlearn at a later stage the greater part of what has been taught to him according to the plan of the book. Here is an example. One of the very first chapters of the book teaches how to draw lines of latitude and longitude suitable for a map of any part of the earth's surface. First it is said, without an attempt at explanation, that it is impossible on a flat piece of paper to draw correctly lines that themselves exist on the round surface of the earth. Then a rough approximation to a rectangular projection in which the real length of the parallels is preserved, is described as the only method of projecting maps, without any further explanation than that the parallels and the central meridian have their real lengths; while it is not shown that the meridians and angles are greatly distorted. In computing distances, the author assumes, adding a brief remark that it is not quite correct, that the distance along the parallel of latitude is the distance between two places. All through the book this looseness prevails. If we agree that the teaching of geometry should train the faculty of logical reasoning, we must object to the methods advocated in this book. From the standpoint of the geographer, there is nothing in it that might not be attained just as satisfactorily by other methods which discard these unnecessary mathematical considerations, that are beyond the grasp of children of that age for which the book is intended.

A Laboratory Manual of Chemistry. By OSCAR OLDBERG and JOHN H. LONG. Chicago, W. T. Keener. 8°. $3.50.

THIS manual is intended for students of pharmacy and medicine, and presents a well-chosen course of experiments, the object of which is to give acquaintance with the properties of the more common elements, and to show the syntheses of the more important chemical compounds and pharmaceutical preparations. A short course in qualitative analysis, special examples of quantitative methods, modes of assay of a few important drugs (notably the alkaloids), and a sketch of the chemical and microscopical examination of urine, constitute important features of the work. In the directions for compounding, quantities are usually expressed in proportionate parts, but occasionally absolute weights and measures are employed. When such is the case, it is a pleasure to note that it is the metric system of which use is made. The pharmaceutical and chemical names appear side by side.

The work is well arranged, and admirably adapted to the use of the class of students for whom it is especially intended.

Skeleton Notes upon Inorganic Chemistry. Part I. Non-Metallic Elements. By P. DE P. RICKETTS and S. H. RUSSELL. New York, Wiley. 8°. $1.50.

IN the words of the authors, "It is not intended that this work shall take the place of a text-book, and the authors claim no originality beyond the general arrangement. Much matter has been purposely omitted for the student to supply in his own way. It is believed that by employing these 'Skeleton Notes' as a framework upon which to build, the beginner will be aided in following lectures, and learn to study chemistry in a systematic manner."

The plan of placing in the hands of students an outline of lecture-notes in order that attention may be given more fully to the general argument and demonstrations of the lecturer, presents many advantages, and has not wanted recognition these many years. That such a scheme may be useful to the fullest extent, it would seem to be the case that the order of topics in the notes should follow the order of discussion in the lecture, and that this should be a rational one. In this skeleton the chemical elements are taken up in the alphabetical sequence of the initial letters of their names, — an arrangement which certainly is not suggestive of existing relationships, nor likely to aid in the realization of the hope that the beginner may "learn to study chemistry in a systematic manner." The notes under individual heads are brief and orderly, in general, though occasionally inexact.

The value of such a book must depend, as a matter of course, upon the use made of it by lecturer and student.

Weather: a Popular Exposition of the Nature of Weather-Changes from Day to Day. By Hon. RALPH ABERCROMBY. New York, Appleton.

THIS volume considers only the practical questions involved, and is an excellent popular work, easily understood, and maintaining great interest in its perusal.

The first three chapters are elementary, and treat of weather prognostics which may be made from 'clouds,' 'audibility,' 'visibility,' 'whirling dust,' etc., without the aid of instruments. In the advanced portion our author takes up the question of weather-maps (Chapter IV.); meteograms, or records of single instruments at a station (V.); squalls, thunder-storms, and non-isobaric rain (VIII.); whirlwinds and tornadoes (IX.); diurnal variation of weather (XI.); types and spells of weather (XIII.); weather-forecasts (XIV. and XV.). These chapters are especially interesting, and deal with their subjects in a lucid and comprehensive manner.

Our author has taken advanced ground on many questions, and does not fear to admit our want of a good explanation of phenomena. No less than twenty-nine times does he profess this, and in almost all these cases there have been theoretical explanations given by others. An important principle is enunciated at p. 50, — "diurnal changes modify but do not alter intrinsic quality of weather," — and this view is maintained in many places with great force and good proof. Our author, while cutting loose from many erroneous views, yet clings to some to which we must take serious exception. On p. 117 we are told that the clouds indicate great cold in front of storms; yet at p. 139 the usual view is given, that, owing to heat, the pressure in the upper layers is augmented near a cyclone; and this latter view is again stated on p. 232. As a matter of fact, later researches have shown that this hypothetical rise in pressure is almost nothing. If we take barometer readings at Mount Washington, for example, during the passage of a cyclone, and reduce them to sea-level, we shall find the fall in pressure at the base only .04″ or .05″ less than at the summit.

On p. 126 we read, "To this ascensional movement (in cyclones) undoubtedly must be attributed the rain and cloud which we find there, — rain near the centre, where the ascensional impulse is strongest; cloud round the outside, where the uptake is less strong." And yet repeatedly our author refers to "non-isobaric rain," or rain remote from just this hypothetical uptake. There is hardly a worse fallacy in meteorology; and, moreover, no valid proof has ever been advanced of this uptake. There has been a rather good reason for the endurance of this theory in Europe, for there, in the temperate regions, rain falls largely near a cyclone-centre; in this country, however, most of the rain is far in advance of the storm-centre. Probably ninety per cent of our rain may be fairly considered 'non-isobaric.' On p. 221, Tyndall's theory that water-vapor absorbs the quality of heat radiated from the ground is accepted; and yet it is quite well known and received to-day, that this was refuted by Magnus, who showed that it was only the condensed vapor in the shape of water-droplets, and not the vapor, that produced the effect. On p. 253 the theory is

accepted that there is a most violent rush of air from under raindrops in a squall. Computation has shown that this cause for the observed wind is purely imaginary, and the air-motion caused by the heaviest possible rainfall is entirely inappreciable. In seeking for an explanation of changes of pressure-distribution, our author, at p. 389, suggests as a cause, "the general circulation of the atmosphere from the hot equator to the cold poles." This statement is hardly borne out by the observations of air-currents.

On the whole, the book is a most admirable and practical exposition of weather-changes, and will repay careful perusal by all interested in the weather and the progress of meteorology.

A Study of the Histological Characters of the Periosteum and Peridental Membrane. By G. V. BLACK. Chicago, W. T. Keener. 8°.

THE contents of this volume appeared in serial form in the *Dental Review*. They include a thorough study of the peridental membrane and its tissue elements, and also of the periosteum, which is so closely related to it. Very little has been written on the subject of the peridental membrane, and until recently there has been very little interest in the subject among dental specialists. Within a short time, however, attention has been directed toward this membrane and its structure, and a great and wide-spread interest has been awakened. There are several reasons for this, among which the following may be mentioned: there is a greater and a more general interest felt now than ever before in the correction of irregularities of the teeth, in which changes in this membrane, and the relation of the parts which it unites, are brought about; and then, too, there is a greater interest manifested by the masses of the dental profession in the retention of pulpless teeth, and roots which have lost their crowns, and which are dependent upon the continued health of the peridental membrane under modified conditions. Another reason which the author advances for the renewed interest in the subject is the revival, under varied forms, of the ancient methods of replanting and transplanting teeth, the success of which is supposed to be dependent, in whole or in part, upon the reconstruction of the peridental membrane, in its re-attachment to the teeth. Dr. Black has made a thorough, and, as it seems to us, an exhaustive study of the subject from an histological standpoint. The illustrations, of which there are sixty-seven, are admirably drawn, and reproduced in a most satisfactory manner. For dentists and those who desire the latest researches into the histology of the periosteum and peridental membrane, this book is invaluable.

The Mind of the Child. Part I. The Senses and the Will. By W. PREYER. Tr. by H. W. Brown. (International Educational Series, Vol. VII.). New York, Appleton. 12°. $1.50.

DR. HARRIS is performing a useful service in the editing of the series of which this work is a volume, and nowhere more so than in the publication of this issue. The work itself is well known, and it will be sufficient to say that it is the very careful and detailed record of the development of Professor Preyer's own child, corroborated by observations from the literature of the topic. The growth of the powers of the senses are studied, and the results controlled by experimental methods. The gradual control of the muscles as the organ of the will is no less carefully pictured, and the work has long been recognized as the most complete contribution to the growing science of 'infant psychology.' The American edition is presented under the most favorable auspices. It is prefaced by an introduction from the pen of Professor Stanley Hall, in which he points out the great educational significance of the work, and demonstrates the practicability of this kind of work in the normal school by a reference to the system in vogue in the Worcester school, of which Mr. E. H. Russel is the principal. Here part of the course in psychology consists in gathering observations of child-life under various rubrics, and studying from this material the psychology of the child-mind. Not only is a valuable material thus gained, but the students are taught to see the meaning of what they are apt to let pass unnoticed, and to enter more intelligently and sympathetically into the thought-habits of the young pupil. The system has been an entire success, many of the normal-school graduates taking such original observations of children as the bases of their graduating theses. The work is creditably translated from the second German edition, and is a very essential contribution to the further spread of useful educational ideas. This is only the first part of Professor Preyer's work. The translation of the second part will soon be ready, and will be anxiously waited for.

Der Tierische Magnetismus (Hypnotismus) und seine Genese. Von JOH. G. SALLIS. Leipzig, 1887. 8°.

De la Suggestion et de ses Applications à la Pedagogie. Par Dr. EDGAR BÉRILLON. Paris, 1888. 8°.

THESE pamphlets are but samples illustrative of the wide-spread interest in the study of hypnotism, that forms so notable a feature of the scientific activity of France, and, to a far less extent, of other European countries. The first of these essays is devoted largely to the historical aspects of the subject; and, in addition to the usual account of Mesmer and his successors, the author brings into connection with hypnotism many of the pseudo-sciences of former centuries, and thus surrounds the history of mesmerism with a suggestive philosophical interpretation. A second leading point in the essay is in the form of a warning as to the dangers of hypnotism, urging that it is a purely technical acquisition, to be used only by experts, and that, above all, is it unsuited for public exhibition by money-making adventurers. The practices of the latter should everywhere (as they have been in many European countries) be forbidden by law. This feeling that Dr. Sallis so forcibly expresses is gaining wider and wider sympathy; and it seems necessary, for the maintenance of the good name that this young science has with difficulty acquired, that it should be placed entirely in the hands of reliable scientists.

Dr. Bérillon's essay contains what at first sight is an alarming proposition: it is nothing less than 'hypnotic moralization.' Unruly, vicious, or lazy children are to be put into the hypnotic condition, and then to have impressed upon them the reformation of their faults. In support of the good that can be thus accomplished, cases are cited in which bad habits of a very perverse type were cured, children backward and sluggish were aroused to a more normal activity, and the benefits thus brought about were shown to be quite permanent. Such a proposition naturally and properly arouses an objection, not only because such an interference with the normal development of the child seems unwarranted, but because we do not as yet know enough of the after-effects of hypnotization to make such an application of what must be a semi-morbid state justifiable. On the other hand, it must be remembered that Dr. Bérillon recommends this treatment only for cases in which ordinary educational means fail, and that it is only to be practised with the consent of the parents and by a skilled physician. He reminds us, too, that many of our reformatory methods interfere with the child's moral freedom, and are equally artificial. We have simply become accustomed to them. He claims, that, if carefully applied, the danger of harmful results is practically *nil*, and has succeeded in gaining the indorsement of several prominent physicians and educators to his plan. It is of course wrong to measure the utility of a project by its liability to abuse; but the abuse is an important factor, and it is at least an open question whether the varied abuses to which the practice here proposed is evidently open does not seriously interfere with its general adoption. The author has at least succeeded in convincing many capable of forming an opinion, that his project is worth a serious consideration.

NOTES AND NEWS.

THE sixteenth annual meeting of the American Public Health Association will be held at Milwaukee, Wis., Nov. 20–23, 1888. The executive committee have selected the following topics for consideration at the meeting: the pollution of water-supplies; the disposal of refuse matter of cities; animal diseases dangerous to man; maritime quarantine, and regulations for the control of contagious and infectious diseases, and their mutual relations. The topics given indicate the subjects which it is desired to consider, yet they are not to be regarded as the exclusive topics of the meeting. Mr. Henry Lomb of Rochester, N.Y., now well known as the originator of the 'Lomb Prize Essays,' offers, through the association, two prizes for the current year, on the following subject: 'Practical Sanitary and

Economic Cooking adapted to Persons of Moderate and Small Means;' first prize to be $500; second prize, $200. All essays written for the above prizes must be in the hands of the secretary, Dr. Irving A. Watson, Concord, N.H., on or before Oct. 15, 1888.

— Dr. William Noyes contributes to the *Journal of Social Science* (No. xxiv.) a convenient summary of the modern view of the criminal type. Taking Lombroso as his guide, he shows in how very many respects the criminal presents abnormal differences, both physical and psychic, from his fellow-men. These differences are to a large extent indicative of a reversal to a more primitive, savage type. It is hopeful to add, that many of the peculiarities can be detected in children, and that the evil results which they forebode can be to a large extent prevented by a properly directed education.

— At the March meeting of the Society of Medical Jurisprudence and State Medicine of New York the best method of executing criminals was discussed. Dr. William A. Hammond advocated strangulation by a silk or cotton rope as the most satisfactory method at command. He criticised the recent report of the State Commission, which recommended the use of electricity, and said that the objections raised against the present method of execution would apply with equal force to any form of execution. Several of the members took exception to Dr. Hammond's statement that strangulation was painless, and Drs. Spitzka and Brill spoke in favor of the guillotine. The society finally adopted, by a nearly unanimous vote, a resolution condemning the bill now before the Legislature, which embodies the recommendations of the State Commission referred to, an abstract of which has already been given in *Science*.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Experiments in Vision Again.

SOME time since in *Science* (No. 262) we referred to an experiment which we thought indicated an interesting connection between monocular and binocular vision. We have another to present here which seems in our own experience to possess a similar importance. It is perhaps even more forcible than the first, and may be worth the attention of those interested in visual phenomena.

Take two circles as represented in Fig. 1, and either bend the sheet of paper in the median plane, so that the circles can be made to appear in inclined planes at any desirable angle, or cut the paper so that they may be held at a suitable inclination to each other in planes that will intersect at any given point. The larger the circles, the better will be the effect, the more clearly marked will be the results we have to describe. Now, if we incline the planes of the circles several degrees, it is well known that the retinal impression becomes ovular or elliptical; and the circles also will appear more or less so, when we make allowance for the judgments of experience which can recognize a real circle, although the impression is not identical with it in form. If, then, we combine the circles by convergence at this slight inclination, the central and fused image will retain its slightly elliptical form, although the surface upon which it appears seems a plane vertical to the median plane. The real inclination of the two surfaces does not appear to determine any irregularities in the effect; but binocular agencies, perhaps, balance the two opposing influences from monocular vision so as to present the appearance of a plane. But if we increase the inclination of the two circles and their planes, say each of them to 45° from the horizontal meridian, and cutting the median plane so as to form a right angle with each other, and then combine them by convergence, the effect may be entirely changed. We find that rivalry may take place between the monocular images, and that there is a tendency to see only one of the images at a time, of those belonging to corresponding points. Not only does the circle appear elliptical, but its plane appears in its real inclination to the median plane; that is, the circle seems to lie in the third dimension, with one side nearer the observer than the other, precisely as it ought to appear in case that vision presents the real relations in space of its objects. This effect may alternate from one inclination to the other, showing that there is rivalry between the monocular images for expression in the field of vision. Fatigue may cause this alternation. But the interesting fact to be noted is, that binocular influences no longer avail to make the plane of the fused images lie in plane of the horizontal meridian. The circle seems inclined to this, and is seen in its real space relations, corresponding exactly to the innervation for the individual eye which sees it. If we may ever speak of monocular influences suppressing those of binocular action, we may do so in such cases as these.

We have been able also to obtain more complicated results of the same general kind. This we accomplished by the use of stereoscopic figures, as in Fig. 2. The experiment is performed as before.

FIG. 1.

If placed at the proper inclination, and combined by convergence, we may notice the inclination of both circles; that is, the monocular images of one concentric set. The same alternation can be observed as before. But by careful practice we have been able to notice the larger circle inclined in one way to the median plane, and the smaller in the opposite way. This makes the planes of the larger and smaller circles of the apparently fused image appear to cut each other at an angle instead of lying in the same plane. This can be explained by supposing that the monocular image of one circle is seen by the right eye, and the monocular image of the other by the left eye. And as each appears to be in the plane in which it really exists, the two must appear to cut each other at an angle. Various alternations may be observed, besides those mentioned in Fig. 1; but they are due merely to the larger number of circles and the different possible relations represented. The results are especially interesting as calling attention to and illustrating the fact that *binocular* disparate points in their visual activity functionate precisely as *monocular* disparate points. This is simply another way of expressing the phenomena of rivalry; for we observe in these, that one area of the right eye may be acting in one way while the corresponding area of the left is inactive, and a disparate area of the left may be acting in another way while the corresponding area in the right is inactive: hence the functional activity of one eye in regard to the larger circle will not prevent the action of the other eye in regard to the smaller circle of Fig. 2. In this case the suppression of one of the binocular images in each case would leave the visual process entirely to monocular functions; and hence, when the inclination of the real planes is great enough to be noticed, it is quite possible that the effect would represent the two circles in different planes cutting each other. It has required much practice, however, to get the results we have described, as the easier tendency, when any inclination of the circles is observed at all, is to per-

FIG. 2.

ceive them both in the same plane, representing the experiment of Fig. 1, only with a greater number of circles. It is quite possible that very many experimenters cannot obtain the effect at all. In our own case we are much aided by the readiness with which the innervation of each eye can be carried on independently of the other. In fact, the phenomenon may be peculiar to our own experience alone, and may not be capable of verification by others. We shall be glad to know if it can be verified. J. H. HYSLOP.

Baltimore, Md., April 26.

Is the Rainfall increasing on the Plains?

I NOTICE a letter from Mr. Curtis in *Science* of April 20, calling attention to an error in the accepted Fort Leavenworth precipitation, due to the reckoning of snow (unmelted) as rain. I have looked up Schott's original manuscript, and find the large precipitation in January, 1871, entered "11.25"?" showing that the compiler was aware of a possible error. A careful examination of the original record shows that the true value is 1.20 for January, and 46.70 for the year. For 1872 the amount should be 51.65. I am inclined to think that Mr. Curtis is altogether too sweeping in his criticism. The probability of such an error having crept into the bulk of the Fort Leavenworth records is exceedingly small; and, moreover, the records nearly all the way through are partially checked by parallel records at neighboring stations.

It is certainly true, that, "if such errors as these exist in the records, it is surprising to find that the rainfall of Kansas is increasing." In this quotation from the letter, I have omitted a 'not' before 'surprising.' The reason is plain. Since 1873 the Fort Leavenworth records are not quoted, but only those of the Signal Service. Now, it is recognized that the exposure of the latter gauge will give too little rainfall; and, moreover, the measurement of melted snow is invariably too small. Both of these causes combine to render the records too small since 1873; and, if we assume that before then the records averaged five to ten inches too great, it is easy to see that there has been an enormous increase in rainfall, if the last fifteen years average more than the previous fifteen.

I wish to call attention to an exceedingly interesting point in this connection. During the last four years, Dr. Carpenter, at West Leavenworth, has reported from five to twenty-five inches more rain each year than the Signal Service two miles due east. Will not some scientist residing near Leavenworth take a special interest, and determine the possibility of such a large increase in precipitation in so short a distance? This will also have a most important bearing on the rainfall question. H. A. HAZEN.

Washington, D.C., April 21.

Chloride of Nitrogen.

IT seems to me worth while to call attention to the fact that the preparation of chloride of nitrogen by the electrolysis of a solution of ammonium chloride, announced in your last issue (p. 206) as a new discovery, has, as a matter of fact, long been known. This method of preparation forms, indeed, one of the stock lecture-experiments in many courses in chemistry. Incidentally it may be noted that within the last few weeks chloride of nitrogen has been made in considerable quantity in Göttingen by Dr. L. Gattermann, who has also for the first time made careful analyses of the substance. The difficulty involved in such an investigation will be appreciated to some extent when it is borne in mind that chloride of nitrogen is probably the most explosive chemical compound known. Dr. Gattermann's investigation has been spoken of in German newspapers as an act of heroism. IRA REMSEN.

Baltimore, April 28.

Christmas Customs in Newfoundland.

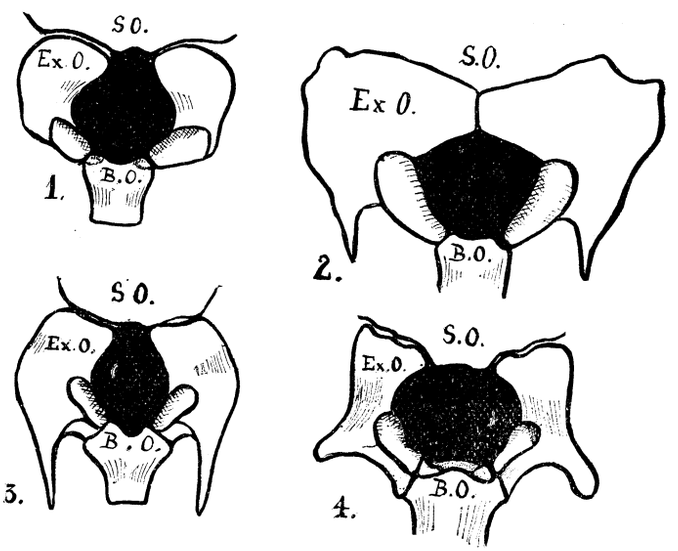
IN *Science* for Feb. 24, 1888, it is said, in the note on 'Christmas Customs in Newfoundland,' that the practice there described of tying a wren to a bush, and singing the rhymes there given, is not known in other places. It may interest your readers to know that fifteen years ago certainly, and probably at the present time, the country boys in County Clare and County Limerick, Ireland, if not in other counties, never let St. Stephen's Day pass without bringing round from house to house a bush adorned with ribbons, with on the top a struggling wren, or, if not a wren, some small bird for that day dignified by the name. The rhymes sung during the cruel ceremony were, I think, identical with those given in your paper. And in some way or other the coppers which the youths pocketed — given them at the houses they visited, whether on condition of releasing the wren or not — were supposed to do honor to the dying bird. W. F. STOCKLEY.

Fredericton, Canada, April 19.

Osteological Notes.

IT is often extremely difficult to determine with accuracy the boundaries of the four centres of ossification which characterize the occipital segment of the cranium in the various orders of the mammalia. The tendency to early co-ossification of these separate centres or bones, as they are generally described by anatomists, is for the most part so great, that it is impossible to obtain the information desired without the aid afforded by the collections of large museums; and, even with this advantage, perfect accuracy of description is scarcely possible in many cases, on account of the lack of material.

As a general rule, with notable exceptions, however, the four bones — viz., the supra-occipital, two ex-occipitals, and basi-occipital — individually contribute, in a greater or less degree, to the formation of the *foramen magnum*, the amount thus contributed by each depending very much upon the shape assumed by that opening (compare Figs. 1 and 4).



In both the odd-hoofed and pair-hoofed animals (*Ungulata*), in the elephants (*Proboscidia*), dugong and manatee (*Sirenia*), in the pangolins (*Edentata*), and in the opossum (*Marsupialia*), the ex-occipitals meet above, and thus shut out entirely the supra-occipital from participation in the margin of the foramen (Fig. 2).

In the remaining orders it may be said that the supra-occipital contributes from a third to a fourth of the border of the great opening, the lines of suture between this bone and the ex-occipitals running slightly upward and outward to a point corresponding with the level of the zygomatic process of the squamosal.

The ex-occipitals, with few exceptions, as in the dog (*Carnivora*) and in the armadillos (*Edentata*), supply the greater portion of the condyloid surface, the remainder being furnished by the basi-occipital.

The lines of suture which mark the separation of these two segments should be drawn from the margin of the *foramen magnum* downwards and outwards, bisecting the inner third of the condyle, to a point corresponding with the centre of the tympanic or auditory bulla (Fig. 4). In the cases where the condyles are the product of the ex-occipitals alone, as in the dog, the lines of separation must be drawn in the same general direction, but not so as to include any of the condyloid surface (Fig. 3). D. D. SLADE.

Museum of Comparative Zoölogy, Cambridge, Mass., March 30.